

What is claimed is:

[Claim 1] A method of controlling a vehicle with a 4x4 driving system comprising:
determining a potential rollover condition; and
transferring driving torque through electronically-controlled center differential or electronically-controlled transfer case to front wheels to prevent rollover.

[Claim 2] A method as recited in claim 1 wherein the step of transferring is performed when a vehicle speed is below a low speed threshold.

[Claim 3] A method as recited in claim 1 wherein the step of transferring is performed when a steering wheel angle is above a steering wheel angle threshold.

[Claim 4] A method as recited in claim 1 wherein the step of transferring is performed when a throttle opening is below a throttle opening threshold.

[Claim 5] A method as recited in claim 1 wherein the step of transferring is performed when a vehicle speed is below a low speed threshold and when a throttle opening is below a throttle opening threshold.

[Claim 6] A method as recited in claim 1 wherein determining a potential rollover condition is performed in response to a roll rate signal.

[Claim 7] A method of controlling a vehicle with a 4x4 driving system comprising:
generating a rollover signal in response to a potential rollover;
increasing a torque in a front wheel through a differential in response to the rollover signal; and
braking a rear outside wheel in response to the rollover signal.

[Claim 8] A method as recited in claim 7 wherein the step of increasing is performed when a throttle opening is above a throttle opening threshold.

[Claim 9] A method as recited in claim 7 wherein increasing the torque comprises increasing the torque to a full torque.

[Claim 10] A method as recited in claim 7 further comprising reducing oversteer yawing in response to increasing the torque and braking.

[Claim 11] A method as recited in claim 7 further comprising braking a front inside wheel.

[Claim 12] A method as recited in claim 11 wherein the steps of increasing and braking are performed when a throttle opening is above a throttle opening threshold.

[Claim 13] A method as recited in claim 7 further comprising determining a wheel lift condition, and wherein braking a front inside wheel is performed during the determination of a wheel lift condition.

[Claim 14] A method as recited in claim 7 wherein increasing the torque is performed using a limited slip differential or a viscous coupling.

[Claim 15] A method as recited in claim 7 wherein increasing the torque is performed using a Torsen differential.

[Claim 16] A method of controlling a vehicle having an active differential comprising:

determining a rollover condition;

in response to the rollover condition, disengaging an inside wheel from an outside wheel with the active differential; and

thereafter, determining a wheel lift condition of an inside wheel.

[Claim 17] A method as recited in claim 16 further comprising applying engine torque to the outside wheel to prevent rollover.

[Claim 18] A method as recited in claim 16 wherein determining a wheel lift condition comprises actively determining wheel lift.

[Claim 19] A method as recited in claim 18 wherein actively determining wheel lift comprises determining wheel lift by applying a change in torque to the inside wheel and monitoring a change in speed of the wheel.

[Claim 20] A method of controlling a vehicle having a first wheel, a second wheel, and an active differential comprising:

during a potential rollover event or stability control event, determining a slip condition of a first wheel of the vehicle;

reducing torque to the first wheel in response to the slip condition using the active differential; and

increasing torque to the second wheel in response to the slip condition using the active differential.

[Claim 21] A method as recited in claim 20 wherein reducing torque to the first wheel and increasing torque to the second wheel are performed with an active center differential.

[Claim 22] A method as recited in claim 20 wherein reducing torque to the first wheel and increasing torque to the second wheel are performed with an active axle differential.

[Claim 23] A method as recited in claim 20 wherein determining a slip condition comprises determining a slip condition in a traction control system.

[Claim 24] A method of controlling a vehicle having an active differential comprising:

determining a rollover condition;

in response to the rollover condition, disengaging an outside front wheel from an inside wheel with the active differential;
applying a braking torque to the outside front wheel; and
applying powertrain torque to the outside rear wheel to counter a deceleration caused by braking the front outside wheel.

[Claim 25] A method as recited in claim 24 wherein applying powertrain torque comprises applying powertrain torque to the outside rear wheel to balance a weight transfer from front to rear.

[Claim 26] A method of controlling a vehicle having an active differential comprising:

determining a rollover condition; and
in response to the rollover condition, using the active differential distributing torque between the front right wheel, front left wheel, rear left wheel and the rear right wheel to prevent rollover.

[Claim 27] A method as recited in claim 23 wherein distributing comprises applying positive torque to the outside front wheel.

[Claim 28] A method as recited in claim 23 wherein distributing comprises reducing understeer by applying positive torque to the outside front wheel.

[Claim 29] A vehicle having a front wheel comprising:

a differential;
a rollover sensor generating a rollover signal; and
a controller coupled to the rollover sensor and the differential, the controller controlling a differential limiting torque to the front wheels to prevent rollover.

[Claim 30] A vehicle as recited in claim 29 wherein the differential comprises an active differential.

[Claim 31] A vehicle as recited in claim 29 wherein the differential comprises an active axle differential.

[Claim 32] A vehicle as recited in claim 29 wherein the rollover sensor comprises a roll rate sensor.

[Claim 33] A vehicle as recited in claim 32 wherein the rollover sensor comprises a roll rate sensor and a lateral acceleration sensor.

[Claim 34] A vehicle as recited in claim 32 wherein the rollover sensor comprises a roll rate sensor, a lateral acceleration sensor and a vehicle speed sensor.

[Claim 35] A vehicle as recited in claim 32 wherein the rollover sensor comprises roll rate sensor, a lateral acceleration sensor, a vehicle speed sensor, and a yaw rate sensor.

